Heinrich Hertz

A Great Physicist

DURING his all too brief life—he died in 1894 at the age of thirty-seven—it fell to the lot of Heinrich Rudolf Hertz to be the first to verify by demonstration the predictions of Clerk Maxwell regarding electro-magnetic waves. Maxwell's work had been speculative and remained but a theory that had not been proved. Hertz, by means of his oscillator, was able to illustrate the truth of Maxwell's remarkable mathematical deductions. A few years ago it was customary to speak of wireless as "Hertzian wave telegraphy," but this seems to be forgotten now, and the work of Hertz is only remembered and appreciated by those who have to deal with the less spectacular side of wireless transmission.

A fine tribute to his memory is paid by Sir Oliver Lodge in his "Work of Hertz." It is so straightforward and simple that no apology is needed for quoting it :—

"In matters of speculative physics others had sown the seed. It was sown by Faraday, it was sown by Thomson and by Stokes. . . . but in this particular department it was sown by none more fruitfully and plentifully than by Clerk Maxwell. Of the seed thus sown, Hertz reaped the fruit. Through his experimental discovery, Germany awoke to the truth of Clerk Maxwell's theory of light, of light and electricity combined, and the able army of workers in that country (not forgetting some in Switzerland, France and Ireland), have done most of the gleaning after Hertz. . . . His name is not over-well known, and his work is immensely greater than that of several who have made more noise."

Heinrich Hertz
1857–1894

Hertz did not discover wireless transmission as we now know it, but there is little doubt that had he lived another six years he would have been an important factor in the development of the new application of electrical discharge. His original "oscillator" consisted of a Leyden jar as a transmitter, and a copper ring, with an adjustable spark gap so that the ring could be almost closed if desired, as a receiver. In 1887, he showed that with the gap properly adjusted, a spark flashed over each time the jar was discharged in its neighbourhood. Thus by means of the "Hertz resonator" as it was afterwards called, he showed that the discharge of a condenser could, under suitable conditions, send out into space an electric wave. It is true that his ring resonator was not suitable for purposes other than demonstration, but more sensitive devices were to follow. Meanwhile Hertz had added another stepping stone to the one first placed by Maxwell. Only two more were necessary to make wireless an accomplished fact.

After his schooldays were over, he decided to take up engineering as a vocation and this subject he was studying up to the age of twenty at Munich, when he felt the call of physics too strong for him, and giving up his course, became a pupil of Kirchhoff and von Helmholtz at Berlin. Prior to attending these lectures on physics, he put in some six months' serious study of the leading textbooks on mechanics and mathematics, at the same time attending laboratory courses on practical physics. This work stood him in good stead, for in 1878 he was deeply immersed in original research on electric inertia, and two years later carried off the prize offered by the University of Berlin for the best paper on the subject. Other important physics papers followed and one on "Induction in Rotating Spheres" earned for him his doctor's degree, with the unusual distinction of *summa cum laude*. About this time he had the good fortune to become assistant to von Helmholtz and for three years he held this position in the Berlin Institute physical laboratory, where he carried out numerous original researches.

Three years later he set to work upon Maxwell's electro-magnetic theory, and by 1899 had succeeded in making the discoveries with which his name will always be associated. The Berlin Academy of Sciences were offering a prize for an experimental proof of Maxwell's deductions, and Helmholtz judged rightly that the problem would make a strong appeal to his favourite and most brilliant pupil. If he did not at once take up the challenge, Hertz kept it in mind; meanwhile other investigators were getting near the solution, though none found it. Finally, in 1887, Hertz was able to supply the solution, and, continuing his work, went on to the discovery of the progressive propagation of electromagnetic action through space and the measurements of length and velocity of electromagnetic waves. He also showed that they could be refracted, reflected and polarised just as in the case of light and heat waves. To quote Helmholtz: "he established beyond doubt that ordinary light consists of electrical vibrations in an all pervading ether which possesses the qualities of an insulator and a magnetic medium."

In 1889 he succeeded Clausius as Professor of Physics at Bonn, where he died in 1894, after a long illness, his last treatise, "Principles of Mechanics," being completed shortly before his death.
L. R. G.

L.F. INTER-VALVE COUPLING

(Continued from page 977).

valves of low impedance and consequently low magnification, the resulting overall amplification due to the valve and transformer may therefore be very little, if any, greater than can be obtained by other methods. A number of special alloys of considerably greater permeability than that of iron are now being employed fairly largely. These enable a smaller magnetic core to be used with consequently greater available space for windings in a transformer of a given size, or alternatively a smaller transformer can be made, using these alloys, to give a performance equal to that of a considerably larger transformer with an iron core.

Considerable difficulties have been experienced in the past owing to breakdown of the very fine wire it is necessary to use in low-frequency transformers in order to get sufficient turns into the available winding space. Corrosion is very liable to occur owing to the presence of minute quantities of acid in soldering fluxes or wax used in the construction of these transformers. Even the handling of this wire by a person with moist hands has been found to give trouble.

These difficulties are now being largely overcome, and in some instances special wire, such as silver wire, is being used to minimise any tendency to corrode.

It will be realised, therefore, that it is possible to obtain satisfactory inter-valve coupling by means of modern transformers, but care must be taken that the transformers are well designed and constructed, and are used with valves of the correct impedance as specified by the makers of the transformers. An important point in this connection is that the value of the steady direct current through the primary of the transformer must not exceed the figure given by the makers, otherwise the primary inductance may be appreciably reduced owing to change in the permeability of the magnetic core, and in addition the winding may be burnt out.

(To be continued)